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(54) Method and apparatus for distributing water to an ion-exchange membrane in a fuel cell

(57) A method and apparatus are provided for distributing water produced by the electrochemical reaction to an ion-exchange membrane in an electrochemical fuel cell. The method comprises periodically reversing the flow direction of an oxidant stream through a fuel cell flow field. The apparatus comprises a fuel stream flow switching device for periodically switching the flow direction of a fuel stream through a fuel cell flow field.

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EUROPEAN SEARCH REPORT

Application Number
EP 03 01 2922

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 0 692 835 A (TOYOTA MOTOR CO LTD) 17 January 1996 (1996-01-17) * claims 1-23 *	1-3	H01M8/24 H01M8/04
X	WO 97/33331 A (RUMMEL WERNER ; SIEMENS AG (DE)) 12 September 1997 (1997-09-12) * the whole document *	1,2	
A	EP 0 074 701 A (WESTINGHOUSE ELECTRIC CORP) 23 March 1983 (1983-03-23) * claims 1-5 *	4	
A	US 3 553 023 A (DOYLE TIMOTHY) 5 January 1971 (1971-01-05) * claims 1-18 *	1-19	
A	WO 91/17580 A (INT FUEL CELLS CORP) 14 November 1991 (1991-11-14) * the whole document *	1-19	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

H01M

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 August 2004	Reich, C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☒ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 03 01 2922

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-4

A method for distributing water to an ion-exchange membrane in an electrochemical fuel cell utilizing water accumulating in a substantially pure fuel stream in a fuel flow field associated with an anode of said fuel cell, said method comprising the step of periodically reversing the direction of flow of said fuel stream through said fuel flow field.

1.1. claims: 5-10

An electrochemical fuel cell assembly comprising an ion-exchange membrane interposed between a cathode and an anode, said assembly further comprising:
an oxidant flow field associated with said cathode for directing an oxidant supply stream to said cathode between a first oxidant flow field port and a second oxidant flow field port;
a fuel flow field associated with said anode for directing a fuel supply stream to said anode between a first fuel flow field port and a second fuel flow field port;
an oxidant stream flow switching device for reversing the direction of flow of said oxidant supply stream between said first and second oxidant flow field ports;
a fuel stream flow switching device for reversing the direction of flow of said fuel supply stream between said first and second fuel flow field ports; and
a controller for periodically operating said oxidant stream flow switching device and said fuel stream flow switching device such that said oxidant supply stream does not flow substantially concurrently with said fuel supply stream between their respective first and second flow field ports.

1.2. claims: 11-19

A fuel cell array comprising a plurality of electrochemical fuel cell stacks, wherein each one of said plurality of fuel cell stack comprises at least one solid polymer fuel cell assembly, said apparatus further comprising a fuel stream flow switching device for periodically reversing the flow direction of fuel stream within at least one of said plurality of fuel cell stacks without simultaneously reversing said fuel stream flow direction in all of said plurality of fuel cell stacks.

Please note that all inventions mentioned under item 1, although not necessarily linked by a common inventive concept, could be searched without effort justifying an additional fee.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 03 01 2922

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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25-08-2004

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82